

XXX. NOTES ON SOME LEECHES IN THE
COLLECTION OF THE INDIAN MUSEUM.

By TOKIO KABURAKI, *Research Student, Imperial University,
Tokyo.*

(From the Zoological Laboratory, the Museums, Cambridge.)

The present account is the result of the examination of a large collection of leeches belonging to the Indian Museum, which was placed by Dr. N. Annaudale in my hands for identification. The material was originally intended for use, in conjunction with Mr. W. A. Harding, in the preparation of a volume in the "Fauna of British India" series on the said group; but, as Mr. Harding is unable to continue the work, it has become necessary for me to take the whole responsibility upon myself, and also to confine myself to a rough investigation, owing to the unavoidable pressure of many other studies during my stay in foreign countries. It is hoped, therefore, that at least some of the species will be subjected to full anatomical investigation in the future.

Most workers on the systematic side complain of the enormous difficulty of determining the species or even the genera of leeches owing to the fact that the descriptions of many of the known species are based solely upon external characters without any regard to internal structure. This seems to me to be more apparent than real. It is, however, necessary, as has been mentioned by Oka (1917), to submit the group to a thorough revision in reference to internal characters. In the present paper, however, I have adopted the generic designations in current use, leaving the problem to those who may have occasion to study personally a large number of forms and especially to re-examine the species previously recorded.

In the leech, as is well known, the large number of rings found on the body resolve themselves into a series of regularly recurring groups corresponding to the successive somites. It has long been recognised that we have to account for twenty-seven somites in the body excluding the posterior sucker, the number of the somites corresponding with that of the ganglia in the central nervous system. Towards the ends of the body the number of rings in a somite becomes smaller, and at the extremities one or more somites are found represented by only one ring.

Much debate has arisen as to the determination of somite-limits. In this communication, however, I have intentionally abstained from taking part in such a discussion and have adopted the neuromeric standard of somite-limits advocated by Moore

(1900), Castle (1906) and some others. The sensory ring may be regarded as corresponding to the middle ring of each typical somite, lodging a ganglionic mass of the ventral chain and in several cases possessing the "metameric sensillae," which are often rendered conspicuous by association with special colour markings and by elevation upon more or less prominent papillae. Of course it is sometimes extremely difficult or nearly impossible to determine the somites by this means, because of the indistinctness or the entire absence of papillae and colour markings. Here, however, I insist upon this conception: the Chinese species *Myxobdella annandalei*, Oka (1917), seems to indicate that the neuromeric standard of somite-limits is true. In this species the body, though wholly devoid of segmental papillae, is divided by deep furrows into distinctly bounded somites, each being subdivided into rings by much shallower ones. The ganglionic mass occupies a position in the middle of each typical somite.

Here I deem it my duty to express my best thanks to Dr. N. Annandale for the privilege of allowing me to examine this large collection of leeches, and to Professor J. S. Gardiner for providing me with accommodation in his laboratory. My thanks are also due to Mr. W. A. Harding for giving and lending me some literature.

The following is a list of the species dealt with in the present paper:—

Sub-order RHYNCHOBDELLAE.

Family ICHTHYOBDELLIDAE.

1. *Ozobranchus jantscanus*, Oka.
2. *Ozobranchus papillatus*, sp. nov.
3. *Pterobdella amara*, Kaburaki.
4. *Cystobranchus anoculatus*, sp. nov.
5. *Piscicola olivacea*, Harding.
6. *Piscicola cacca*, Kaburaki.

Family GLOSSOSIPHONIDAE.

7. *Hemiclepsis marginata* (O. F. Müller).
8. *Glossosiphonia weberi*, R. Blanchard.
9. *Glossosiphonia lata*, Oka.
10. *Glossosiphonia ceylanica*, Harding.
11. *Glossosiphonia reticulata*, sp. nov.
12. *Placobdella emydae*, Harding.
13. ? *Placobdella gracilis* (R. Blanchard).

Sub-order ARHYNCHOBDELLAE.

Family HERPOBDELLIDAE.

14. *Herpobdella lineata* (O. F. Müller).
15. *Herpobdella hexoculata*, sp. nov.
16. *Herpobdelloidea lateroculata*, gen. et sp. nov.

17. *Nematobdella indica*, gen. et sp. nov.
18. *Foraminobdella heptamerata*, gen. et sp. nov.
19. *Scaptobdella horsti*, R. Blanchard.

Family GNATHOBDELLIDAE.

20. *Whitmania lacvis* (Baird).
21. *Limnatis nilotica* (Savigny).
22. *Limnatis granulosa* (Savigny).
23. *Haemopsis sanguisuga* (Linnaeus).
24. *Haemopsis birmanica*, R. Blanchard.
25. *Haemopsis corcolor*, sp. nov.
26. *Myxobdella annandalei*, Oka.
27. *Haemadipsa zeylanica* (Moquin-Tandon).

Sub-order RHYNCHOBDELLAE.

Family ICHTHYOBDELLIDAE.

Genus *Ozobranchus*, de Quatrefages.

1. *Ozobranchus jantseanus*, Oka, 1912.

Numerous specimens of a species identical with Oka's *Ozobranchus jantseanus* from China were obtained by Dr. B. L. Chaudhuri from a *Kachuga donghoka* in the Zoological Gardens of Calcutta, which was originally brought from Oodhua near Rajmahal.

The body is depressed and formed of two distinct regions, a short narrow neck and a long large abdomen, the former being partly invaginated into the abdominal region, as is the case with *Branchellion*. The abdomen is provided with eleven pairs of digitate branchiae, of which the anterior are much larger and more branched than the posterior. The anterior sucker is very small and not distinct from the neck, while the posterior represents a large cupuliform disc with a diameter about as broad as the abdominal part of the body. The large examples are about 25 mm. in length, without the posterior sucker, and 7 mm. across at the middle of the abdomen.

The complete somite is formed of two rings of different size, the first ring being enlarged and the second narrower. In the abdominal, but not in the neck region, each ring, as stated by Oka (1917), is in some cases marked on the dorsal surface with a transverse row of papillae beset with more than one sharp point.

In the preserved specimens the body, though colourless in most instances, is sometimes of a brownish colour, without any trace of markings.

A pair of eyes lie slightly behind the level of the mouth which opens near the centre of the anterior sucker.

The male and female genital organs open in common at the base of the neck, where the latter merges into the abdomen.

The anus is located on the dorsal surface between the last two somites of the body.

2. *Ozobranchus papillatus*, sp. nov.

The collection contains some examples which appear to represent a new species, found by Mr. E. A. D'Abreu on the leg of *Kachuga tectum* at Nerbudda, Nagpur.

The species closely resembles the preceding, in its external features there being distinguished two distinct regions, the neck and the abdomen, with the eleven pairs of digitate branchiae. The typical somite consists of two rings of nearly similar breadth, each ring in the abdomen being provided with conical papillae on the dorsal surface. The papillae are of small size and present a single sharp end, differing from *O. jantseanus*. The colour of the body is grey and exhibits no trace of markings, except a darker shade in the anterior region of the abdomen. All the specimens are strongly contracted and are about 7 mm. long by 4 mm. broad at the middle of the abdomen. The most conspicuous character which distinguishes this species from *O. jantseanus* is the absence of any trace of eye-like organs.

Genus *Pterobdella*, Kaburaki.3. *Pterobdella amara*, Kaburaki, 1921.

In a recent paper ¹ I placed on record in some detail this interesting species which was found in the Chilka Lake, adhering to the mouth of *Hypolophus sephen* and *Trygon uarnak*. The trunk is of a peculiar shape, being divided into three distinct regions, of which the anterior two each carry a pair of conspicuous lateral *fin-like bodies*. *The visual organs are entirely absent.*

Genus *Cystobranchus*, Diesing.4. *Cystobranchus anoculatus*, sp. nov.

In the collection there are three specimens which appear to represent an interesting member of the genus *Cystobranchus*, their locality being unknown. Hitherto recognised as belonging to this genus are four species,—*C. respirans* (Troschel), *C. fasciatus* (Kollar), *C. vividus* Verrill and *C. mammillatus* (Malm),—all ectoparasitic on various freshwater fish such as *Cyprinus carpio*, *Barbus fluviatilis*, *Thymallus vulgaris*, *Rhodens amarus*, *Trutta fario*, etc. Of these species *C. mammillatus* seems to be by far the most closely related to the species here described.

In shape this leech conforms to the typical *Cystobranchus*-outline, with the short narrow neck, distinctly separated from the abdomen, which is elongate, wide, of a nearly uniform breadth for the greater part of its length and is provided, as in all species of the genus, with eleven pairs of pulsating vesicles. The suckers are large and are centrally attached, the anterior sucker being about one-third as wide as the posterior. In no case have I been

¹ See Kaburaki, *Mem. Ind. Mus.* V, p. 608, figs. 3, 4.

able to observe any trace of the dark spots on the posterior sucker, which are to be observed in *C. respirans*. The body is about 21 mm. long by 3.5 mm. across in the middle of the abdominal region.

The complete somite is formed of seven rings. In the first eleven somites of the abdominal region each somite carries a pair of the pulsating vesicles which, in diastole, arch up the skin, usually extending over rings 2 to 5.

The leech is wholly devoid of any trace of eyes, as is the case with *C. mammillatus*.

The body in the preserved state is of a dirty brown colour, being marked with a darker shade in the region of the genital openings, just anterior to the abdomen.

The mouth lies near the centre of the anterior sucker and leads into the pharyngeal sheath with the pharynx, which is cylindrical in shape and extends over about three somites, vii-ix. Widely distributed on either side of the pharynx are numerous salivary glands, which make their way to the base of the pharynx. The crop represents a distensible part of the digestive tract and is provided with seven pairs of subdivided lateral diverticula which come off metamerically in each of the first seven somites of the abdomen. The last pair are reflected posteriorly and extend into somite xxii, giving off a secondary, outwardly directed diverticulum in each somite and appearing to fuse together metamerically, as stated by Johansson. The stomach possesses four pairs of nearly pear-shaped lateral pouches, a pair in each of somites xix-xxii. The intestine is in the form of a more or less wide canal, passing to the dorsally situated anus between somites xxvi and xxvii. The walls of the stomach and intestine are richly supplied with blood vessels.

The vascular system seems to be similarly constructed to that of other Ichthyobdellids, there being the dorsal and ventral vessels, which lie respectively in the dorsal and ventral sinuses of the coelome. These sinuses give off metamerically arranged transverse branches and communicate with the lateral vesicles, thus forming a complete circle.

The male genital orifice, though I could not determine it with certainty, appears to lie between the last two rings of somite xi; the female orifice is seven rings behind the male, that is in somite xii.

The six pairs of testes lie anterior to each of the first six pairs of lateral diverticula of the crop. Anteriorly the vasa deferentia on each side assume the character of a wide tortuous passage, and after uniting to form the "prostate," open to the exterior by the male orifice. The female organs appear to be similar in structure to those of other Ichthyobdellids.

Genus *Piscicola*, Malm.

5. *Piscicola olivacea*, Harding, 1920.

This species, as mentioned in my recent paper (*loc. cit.*), is fairly common in the Chilka Lake and occurs usually attached to

the body, or to the palate within the mouth, of fish such as *Hypolophus sephen*, *Tetrodon reticularis* and *Dorosoma indica*. In shape this leech conforms to the typical *Piscicola*-outline, with the circular suckers, of which the anterior is rather less than half the size of the posterior sucker. The eleven pairs of pulsating vesicles are conspicuous, especially in the living forms. Situated dorsally on the anterior sucker are two pairs of eyes, as in *P. geometra*, Linn.

6. *Piscicola caeca*, Kaburaki, 1921.

This leech inhabits the Chilka Lake and was found attached to the jaw of *Hypolophus sephen*. It is closely allied to the preceding species, but may be easily distinguished from it by the absence of eyes.

Family GLOSSOSIPHONIDAE.

Genus *Hemiclepsis*, Vejdovsky.

7. *Hemiclepsis marginata* (O. F. Müller), 1774.

Hirudo marginata (O. F. Müller), 1774.
Glossosiphonia marginata, Moquin-Tandon, 1846.

Some examples of a species identical with *Hemiclepsis marginata* were collected by Dr. F. H. Gravely at Bagra in Hoshangabad District and also by Dr. T. Southwell from a species of *Lamellidens* at Bhandardaha Beel in the Murshidabad District. The species is one of wide distribution, being known to occur throughout the greater part of Europe, China and Japan.

The body in the preserved condition is elongate-lanceolate, the head being separated from the trunk by a slight neck-like narrowing. The dorsal surface is marked with very weakly developed papillae. Centrally attached is the posterior sucker, which is of a nearly circular shape. The largest specimens are about 7 mm. long by 4 mm. across at the middle of the body.

Counted on the dorsal surface are seventy-two rings, which appear to be grouped as follows: somites i and xxvii are unianulate; ii, iii, iv, xxv and xxvi biannulate; the twenty somites v-xxiv are complete with three rings.

The two pairs of eyes lie in rings 3 and 4 respectively, the first pair being much smaller than the second.

The body is of a yellowish colour in spirit and is marked with pigment-patches which occupy a definite position on the rings, so that those on successive somites form seven longitudinal rows, three in each half of the body and one median in position. The paired rows may be designated as marginal, intermediate and paramedian. The patches forming the median and marginal rows fall on the second ring of each typical somite, while those composing the paramedian and intermediate rows occur on the first ring. The median row is much more conspicuous than any of the others.

The mouth is situated near the centre of the anterior sucker. Extending over about three somites, vii-ix, is the pharynx, which is of a cylindrical shape. The crop is provided with some ten pairs of subdivided lateral diverticula, one pair in each of somites x-xix. The last pair are reflected posteriorly, giving off four secondary, outwardly directed diverticula. The stomach bears four pairs of lateral pouches which lie within the three somites xx-xxii. Opening on the dorsal surface is the anus, which occurs between the last two somites.

The male genital orifice, though I could not find it out definitely, seems to lie between somites xi and xii, and the female orifice is two rings behind the male, that is between the second and third rings of somite xii.

Genus *Glossosiphonia*, Johnson.

8. *Glossosiphonia weberi*, R. Blanchard, 1897.

(Text-fig. 1.)

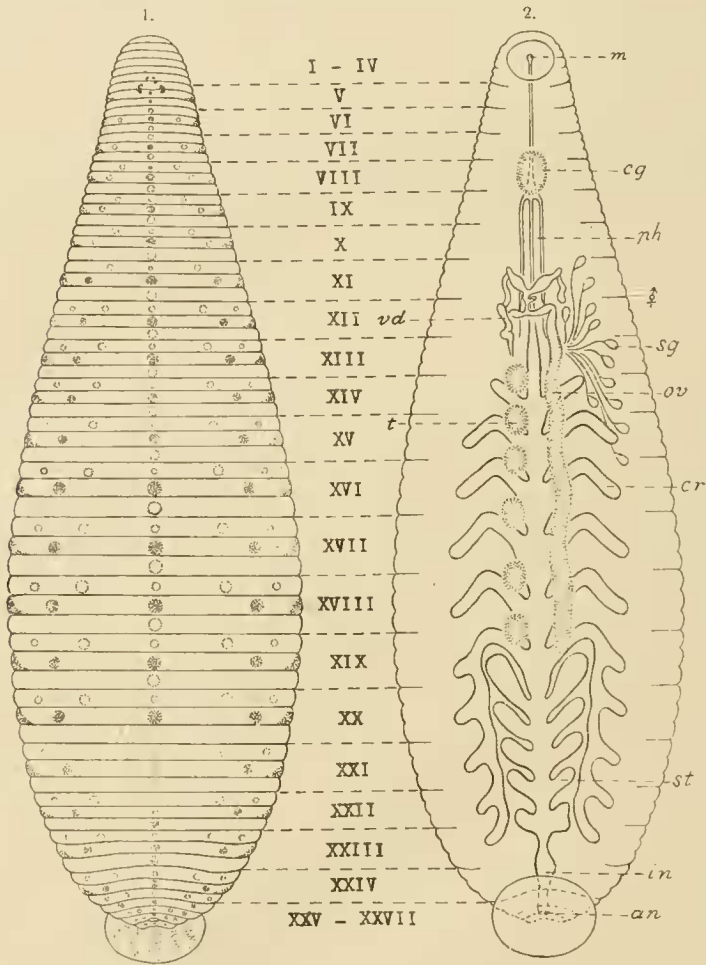
The material was found at the north end of Lake Loktak, Manipur, adhering to the body of *Vivipara oxytropis* (Beuson).

On examination, the species, though exhibiting a small difference in the position of the genital orifice, proves to be identical with Blanchard's *Glossosiphonia weberi* from Sumatra described by that author. *Gl. weberi* is very closely related to *Gl. heteroclita* (Linn.) which is of wide distribution in Europe and America, but it is distinguishable from it by the possession of numerous well-developed papillae on the dorsal surface.

The body is generally of small size, in a full grown condition being 8 mm. long, exclusive of the posterior sucker, by 4 mm. across at the middle. In the preserved state the body as seen in dorsal aspect is ovate-elliptical in form, broadest slightly behind the middle, and thence tapering more gradually to the anterior than to the posterior end. The dorsal surface is much arched and quite rough all over, owing to the presence of numerous well-developed conical papillae, while the ventral surface is nearly flat and entirely smooth. The anterior sucker, as in all species of *Glossosiphonia*, lies on the ventral side of the head, within the limits of rings 1-5. The mouth is situated slightly anterior to the eyes, well forward in the anterior half of the said sucker. The posterior sucker is sometimes ventral in position and of a small ovate or circular shape, the diameter being about 1 mm.

The external rings are rather conspicuous; counting dorsally, so far as my observation goes, there are seventy in front of the posterior sucker, of which the preocular rings are in most cases five in number, and rings 5 and 6 coalesce on the ventral surface, forming the posterior margin of the anterior sucker. Blanchard speaks of there being four preocular rings in the Sumatran form, but the number, as Castle (195a) has pointed out, is not constant in the case of *Gl. heteroclita*, and no doubt varies to some extent in

Gl. weberi. The composition of the somites is practically the same in this species as in *Gl. heterochita*. There are twenty-seven somites, of which somites i, ii, xxvi and xxvii are uniannulate; iii, iv and xxv biannulate; the twenty somites are complete, each consisting of three rings.



TEXT-FIG. 1.—*Glossosiphonia weberi*, R. Blanchard.

1. Diagram showing the annulation and external features of the dorsal surface.

2. Diagrammatic representation of the organization, as seen from the dorsal side; *an.*, anus; *c.g.*, cephalic ganglionic mass; *cr.*, crop; *in.*, intestine; *m.*, mouth; *ov.*, ovary; *ph.*, pharynx; *s.g.*, salivary gland; *st.*, stomach; *t.*, testis; *v.d.*, vas deferens.

The three pairs of eyes are arranged so as to form three groups. The eyes composing the anterior and smallest pair are closely approximated in ring 6, while those forming the second and third pairs are wider apart, occurring in rings 7 and 8

respectively, and are closely apposed on each side. The first two pairs are directed obliquely forwards, the last pair obliquely backwards; all are turned away from the median plane.

Dorsally the rings are marked, as stated above, by conical papillae, which are of various size, and form a transverse row of about 11-17 on every ring. In each transverse row the papillae are arranged, as a rule, symmetrically, some being of larger size and occupying a definite position on every ring, so that those on successive somites form seven longitudinal rows, three in each half of the body and one median in position, as is shown in text-fig. 1. The paired rows may be designated as paramedian, intermediate, and paramarginal. The paramedian rows of non-pigmented papillae are usually constant in occurrence with the intermediate; they fall on the first ring of each somite. The intermediate rows occur upon the second ring of each somite, and usually contain pigment. The papillae composing a median row exist on every ring, though those on the first of each somite are often inconspicuous. The paramarginal rows are less well-developed than any of the others, occurring on the first ring of each somite. This regularity of arrangement loses itself as it proceeds towards both ends of the body.

The body presents a whitish colour in spirit, marked with five longitudinal rows of dark-brown or black pigment-patches which are arranged metamericly extending backwards almost throughout from somite v. These patches mark most often the middle ring of each somite in the position of the papillae forming the median and intermediate rows, as well as at the lateral edge where the dorsal surface passes round to the ventral. On some occasions the median row is seen, without being interrupted, as a continuous stripe. On the posterior sucker we find pigment-patches arranged in some five radial stripes, which correspond to the median, intermediate and marginal rows mentioned. In no case have I been able to observe any trace of special sensory spots.

The specimens had not been preserved in a state fit for the purpose of minute examination. The mouth situated anterior to the middle of the anterior sucker leads into the pharyngeal sheath which extends posteriorly into about somite xii. In it lies the pharynx which is of a cylindrical shape, terminating conically at the free end. At the base the pharynx is furnished from both sides with the ducts of the salivary glands scattered through as many as eight somites, usually somites x-xvii. Posteriorly the pharynx gives rise to the oesophagus, which is a tubular passage opening into the crop, and much longer than that of *Gl. heteroclita*. The wall of the oesophagus is composed of columnar epithelial cells closely set, surrounded by circular muscles. The crop is provided with six pairs of lateral diverticula, one pair in each of somites xiv-xix. In these diverticula there cannot be demonstrated such a tendency to subdivide into two at the tip, as is seen in *Gl. heteroclita*, except in the last pair which extend backwards into somite xxiii and gives off about five secondary, outwardly

directed diverticula, coming off metamericly in somites xix-xxiii. The crop presents a very thin wall and was found to be filled with a dense coagulum. Opening from the crop in somite xix is a short tube leading directly into the stomach which is provided with four pairs of lateral pouches, lying within somites xix-xxii. In structural respects this differs from the crop, possessing its wall which is made up of closely apposed, columnar epithelial cells, surrounded by two sets of muscular fibres, circular and longitudinal. Posteriorly the stomach is continuous with the intestine, which in its course is divided into two chambers by a constriction and finally opens on the dorsal surface between rings 69 and 70.

The vascular and coelomic systems, so far as my observation goes, seem to be constructed on the same plan as in most of the Glossosiphonids.

There are some seventeen pairs of nephridia, the ducts of which lie in the lateral parts of the body, forming a convolution in the central portion. The duct opens ventrally on the middle ring of a somite, somewhat nearer the margin than the median line.

The cephalic ganglionic mass lies for the most part in somite viii, consisting, as usual, of the fused ganglia of the first six somites. The arrangement of its ganglionic capsules is the same as that found in *Gl. heteroclita*, though the most ventral and posterior capsule of neuromere i in the present species exhibits no horn-like process extending backwards laterally into contact with the lateral capsules of neuromere iii. Between the cephalic and acetabular ganglionic masses there exist ventrally twenty-one distinct ganglia, which are metamericly arranged and joined by paired connectives. The usual position of the ganglion is in the middle ring of each somite. Towards either end of the body, however, there can be found a slight centripetal displacement of the ganglia, as is seen in many leeches.

The genital organs agree in the main with *Gl. heteroclita*, opening by a common aperture which at a glance seems to lie in the middle of the ring as has been stated by Blanchard. A closer examination, however, has revealed that it is situated between somites xi and xii. It may be considered probable that Blanchard was mistaken, as in the case of *Gl. heteroclita*, in determining the position of the opening.

The male elements consist of six pairs of follicular testes situated intermetamerically on both sides of the median line in somites xiii/xiv-xviii/xix. They are connected on each side by short vasa efferentia with the vas deferens, which proceeds forwards, pursuing a tortuous course, and then dilates into a thick-walled tube, the "prostate." Its entire course could not be definitely made out. About the region of somite xi the prostate on each side makes an abrupt turn downwards and inwards, uniting into a short common duct, which soon opens to the exterior by the common genital aperture from the front.

The female elements are composed of a pair of simple dilated sacs lying ventrally on both sides of the crop and extending almost throughout its whole length. Before opening out by the common aperture from behind, the sac unites with its fellow of the opposite side to form a very short single duct.

9. *Glossosiphonia lata*, Oka, 1910.

Only one example, which appears to be identical with this species, was collected by Professor N. Gist Gee at Soochow, China.

The body is ovate-elliptical, of a firm consistency and presents dorsally a roughened surface owing to the occurrence of papillae. The posterior sucker is a small circular disc, its diameter being about 1 mm. The specimen is 11 mm. in length and 5 mm. in width at the middle of the body.

On the dorsal surface there are seventy-two rings, of which the preocular number seven. These rings, though I could not definitely make them out, appear to resolve themselves into a series of somites somewhat as follows: somites i, xxvi and xxvii are uniannulate; ii, iii, and xxv biannulate; and twenty-one somites complete with three rings.

The three pairs of eyes are similar in their arrangement to those found in the preceding species. The first and smallest pair are approximated in ring 8, while the second and third pairs are wider apart, lying in rings 9 and 10 respectively.

The dorsal surface is marked all over with numerous well-developed papillae which are of various sizes. The larger papillae on successive somites are arranged symmetrically, so as to form seven longitudinal rows, as is seen in *Gl. weberi*. Medially situated on the first and second rings of each typical somite are the papillae which form the median row. The papillae forming the paramedian rows fall on the first ring of each somite in association with those of the paramarginal, which are less developed and partly inconspicuous; while those composing the intermediate rows are situated on the second ring.

In the preserved state the body is of a dark olive colour, marked on the dorsal surface with nine dark brown longitudinal stripes, one median in position and four in each half of the body. Of these four lateral stripes two lie between the median and paramedian rows of papillae, and the other two run just inside the intermediate and paramarginal rows respectively. Besides these an olive-like brown patch marks the middle ring of each somite at the lateral edge of the body. On the ventral surface are also found some interrupted longitudinal stripes which present no regular arrangement.

The crop is provided with six pairs of distally subdivided lateral diverticula, of which the last pair are reflected posteriorly and give off four outwardly directed secondary diverticula. The stomach gives rise, as is usual, to four pairs of pouches. The anus

opens on the dorsal surface between the last two rings of the body.

The male genital orifice is situated between somites xi and xii, and the female orifice appears to open on the first ring of somite xii. There are six pairs of testes, which are each placed in front of the lateral diverticula of the crop.

As is evident from the above, the present species is closely allied to the preceding, *Gl. weberi*; it is distinguished chiefly by the different arrangement of the pigment pattern.

10. *Glossosiphonia ceylanica*, Harding, 1909.

This species is not peculiar to Ceylon, as some examples which I have examined were found in the neighbourhood of Lake Chilka and at Rawalpindi. A full account has been given in my recent paper (*loc. cit.*).

11. *Glossosiphonia reticulata*, sp. nov.

(Text-fig. 2.)

A single individual only, which seems to represent a new species, was collected by Dr. B. Prashad at Jullundur, it having been found attached to the mantle of a species of *Lamellidens*.

The body in the preserved state is slender and broadest at the posterior region, from which it tapers gradually towards the anterior end. The head is marked off from the trunk by a slight neck-like narrowing. The dorsal surface presents a roughened appearance, due to the presence of papillae of various sizes, of which the larger ones are arranged so as to form three longitudinal rows, one median and two lateral. The posterior sucker is of a circular shape and is almost centrally attached. The specimen is 10 mm. in length, exclusive of the posterior sucker, by 2 mm. across at the broadest part of the body.

The body appears to comprise in all seventy-two rings, which are grouped somewhat as follows: somites i and ii are uniannulate, iii, iv, xxv, xxvi and xxvii biannulate; and the twenty somites v-xxiv complete with three rings. The papillae occur on almost all of the rings.

There are two pairs of eyes, of which the first and smaller pair lie in ring 4, the second and larger in ring 5.

The preserved specimen is of an olive grey colour due to irregular pigment present all over in reticular distribution as well as to the contents of the crop.

The mouth opens in front of the centre of the anterior sucker. The pharynx represents a long cylindrical tube, beginning just behind the cephalic ganglionic mass situated in somite vii and extending behind into somite x. At the base it is supplied with numerous ducts of the salivary glands which are widely distributed in the anterior region. The crop is a distensible part of the digestive tract and is provided with seven pairs of subdivided diverti-

cula, which occur metamericly in each of somites xiii-xix. The last pair are reflected posteriorly and extend into somite xxiii, sending out four lateral pouches in each of somites xix-xxii. The stomach bears four pairs of lateral pouches and posteriorly joins the wide intestine which opens dorsally between the last two somites.

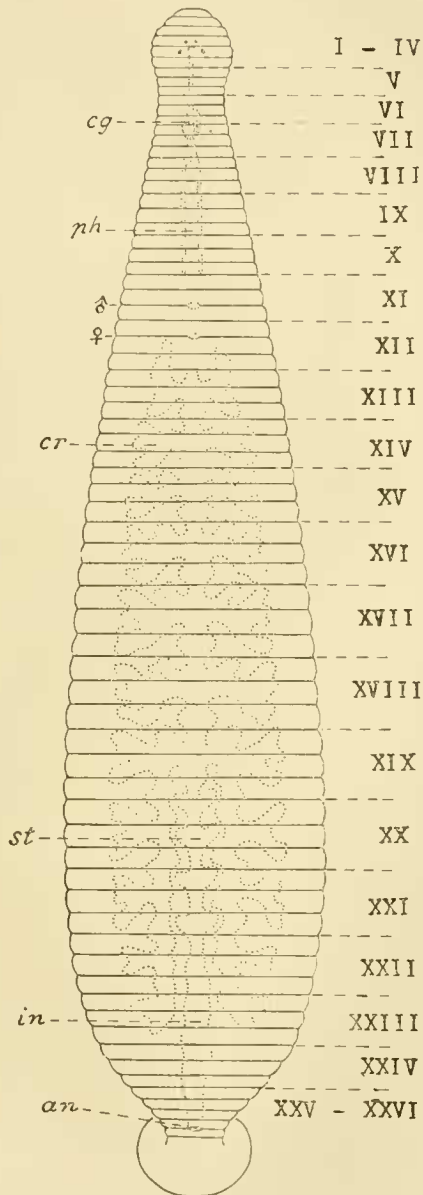
The male genital orifice is placed between somites xi and xii; the female orifice lies two rings behind the male, that is, between the second and third rings of somite xii.

The present species seems to be allied to *Gl. smaragdina*, Oka, rather than to *Gl. paludosa*, Carena, but may be distinguished from them chiefly by the different arrangement of eyes as well as in the possession of well-developed pigment all over the surface.

Genus *Placobdella*, R.
Blanchard.

12. *Placobdella emydae*,
Harding, 1921.

The collection contains a few individuals identical with Harding's *Placobdella emydae*, described in detail by that author from Lake Chilka and elsewhere. The material was collected by Dr. F. H. Gravely at Hoshangabad, Central Provinces, and at an elevation of about 2000 ft in Taloshi, Koyna Valley, in the Satara District. An example



TEXT-FIG. 2.—*Glossosiphonia reticulata*, sp. nov.

Diagram showing the annulation and some internal features: dorsal aspect. Index letters as in text-fig. 1.

found with *Limnatis granulosa* in Burma seems to be identical with the present species. This leech, according to Harding, is fairly common in India and is usually to be found attached to the mud-turtle.

The body is flattened and lanceolate, presenting a head region which is separated from the trunk by a slight neck-like narrowing. The dorsal surface exhibits a roughened appearance due to the presence on each ring of numerous papillae, which are of various size, the larger ones forming some five longitudinal rows, one median in position and two lateral in each half of the body. The anterior sucker lies on the ventral side of the head, within the limits of rings 1-6, the mouth opening near the anterior lip. The posterior sucker is centrally attached and of a small circular shape. The large specimen is about 8 mm. long by 3 mm. across at the hind part of the body.

The colour in spirit is grey or pale olive brown without any trace of markings.

On the dorsal surface seventy-one rings are counted in front of the posterior sucker. Somites i, ii and xxvii, are uniaunulate; iii, iv, xxv and xxvi biannulate; the twenty somites, v-xxiv, are complete with three rings.

A pair of eyes is generally placed in ring 3, but may occasionally be shifted behind so as to extend over ring 4.

The crop is provided with seven pairs of lateral diverticula, a pair in each of somites xiii-xix, which are sometimes subdivided distally. The last pair are, as usual, reflected posteriorly and extend into somite xxii, giving off a secondary, outwardly directed diverticulum in each of the four somites xix-xxii. The anus is situated on the dorsal surface between the last two somites.

The male and female genital orifices are separated by two rings, the male orifice being situated between somites xi and xii, the female between the second and third rings of somite xii.

In one case, attached to the ventral surface of the parent, were found numerous larvae which were about 1 mm. in length.

13. ? *Placobdella gracilis* (R. Blanchard), 1897.

Helobdella gracilis, R. Blanchard, 1897.

The collection contained a single specimen, which was found at Nandi, Mysore State, attached to *Limnacea acuminata* and was not in a state fit for close study and exact identification. The body, presenting a dark grey colour in spirit, is fusiform and of small size, being about 5 mm. in length. This leech may be referred to Blanchard's *Helobdella gracilis* from Java described by that author.

Sub-order ARHYNCHOBDELLAE.

Family HERPOBDELLIDAE.

Genus *Herpobdella*, de Blainville.14. *Herpobdella lineata* (O. F. Müller), 1774.*Hirudo lineata* (O. F. Müller), 1774.*Nepheleis quadristriata*, Grube, 1850.*Nepheleis lineata*, Budde Lund, 1873.*Dina blasei*, R. Blanchard, 1892, 1893, 1894.*Dina lineata*, *ibid.*, 1892.*Nepheleis gallica*, *ibid.*, 1893.*Dina quadristriata*, *ibid.*, 1894.*Nepheleis bistriata*, Brandes, 1900.*Herpobdella bistriata*, Johansson, 1906.

Several specimens of *Herpobdella lineata* were collected by Col. H. T. Pease at Lahore. This species is of wide distribution, having been known to occur in Europe, Palestine, Siberia, Mongolia, North and Central America, Madeira and the Azores.

The body in the preserved condition is elongate, flattened, and of a uniform width for the greater part of its length, though it is attenuated anteriorly. Large specimens are about 25 mm. in length by 3 mm. across at the middle of the body.

The colour in spirit is brownish-yellow without any trace of the longitudinal stripes which are usually a conspicuous feature of the colouration of the typical form.

Somites i, ii and xxvii are uniannulate; iii, iv and xxvi biannulate; v and xxv triannulate: the nineteen somites vi-xxiv are complete with five rings, of which the last ring, although often difficult to detect, is usually enlarged and divided transversely by a superficial furrow. Occasionally the same subdivision is true of the ring forming somite ii.

There are in all four pairs of eyes of which the first and second pairs lie in a transverse curved line in somite ii and the third and fourth are placed in the first ring of somite iv.

The male genital orifice lies on the second ring of somite xi; the female orifice is two rings behind the male, that is between the fourth and the last ring of the same somite.

The anus lies on the dorsal surface between somites xxv and xxvi.

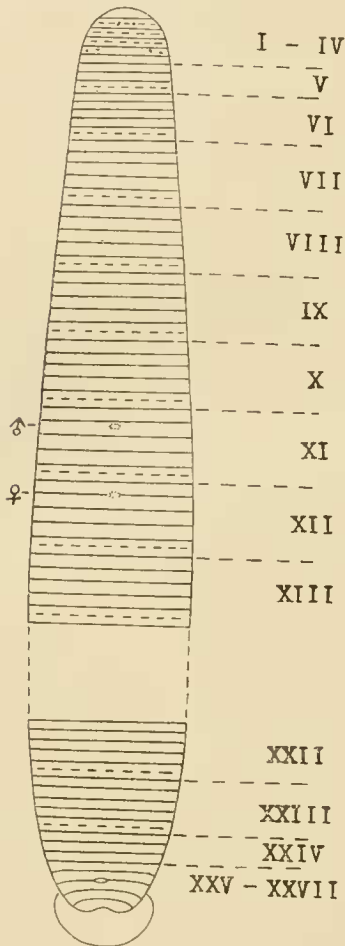
15. *Herpobdella hexoculata*, sp. nov.

(Text-fig. 3.)

Numerous examples of this species, which appears to be new to science, were collected by Dr. F. H. Gravely at Burhampur and Hoshangabad, as well as by Dr. N. Annandale from the Baitulgharib stream about eight miles from Nowshera in the Peshawar District.

The body in the preserved state is elongate, flattened, attenuated anteriorly, bluntly rounded posteriorly, and of nearly similar breadth posterior to the genital region. The posterior sucker is

small and circular in outline, its diameter being about 1 mm. The large examples measured about 25 mm. in length and 2 mm. in breadth at the middle of the body.



TEXT-FIG. 3.—*Herpobdella hexoculata*, sp. nov.

Diagram of the anterior and posterior extremities, as seen from the dorsal side.

The anus is situated on the dorsal surface between somites xxv and xxvi.

The present species is nearly allied to *Herpobdella weberi* which is known to occur in Java, Sumatra and Celebes, but may be distinguished from it chiefly by the absence of the two supplementary genital orifices on the ventral surface.

The colour in spirit is light brownish yellow, marked with irregular pigment present all over in reticular distribution.

The rings forming the body number in all 107, which appear to resolve themselves as follows: somites i, ii and xxvii are uniannulate; iii, iv, xxv and xxvi bianulate; v and xxiv triannulate; eighteen somites vi-xxiii are complete with five rings, of which the last ring in each somite is broader than the others, being transversely subdivided into two primitive rings. The same is true of rings 2, 3, 4, 9, etc.

There are three pairs of eyes, the first pair lying in somite ii and the second and third pairs being situated in the first ring of somite iv, as is the case with *Herpobdella weberi* (R. Blanchard).

The male genital orifice exists on the second ring of somite xi; the female orifice lies five rings behind that of the male, that is between the first and second rings of somite xii.

Genus *Herpobdelloidea*, nov.

16. *Herpobdelloidea lateroculata*, sp. nov.

(Text-fig. 4.)

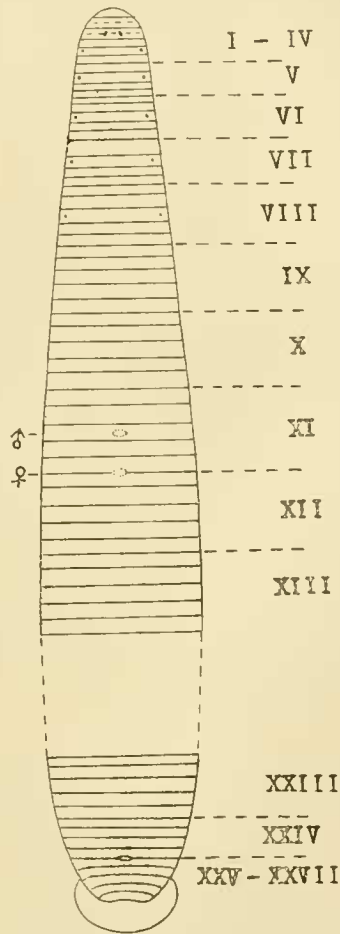
Some examples of this interesting species, which seems to be new to science, were collected by Dr. F. H. Gravely at Burhampur and also at Sangor in the Central Provinces.

This leech presents a great resemblance in its form and size to the preceding two species. The body is of nearly similar breadth posterior to the genital region, from which it tapers gradually towards the anterior end. The dorsal surface is more or less rough all over, owing to the presence of minute papillae which present no regularity in arrangement. Most of the specimens are of similar dimensions, measuring about 14 mm. long by 3 mm. broad at the middle of the body.

The colour is faded in spirit to a pale yellow, on some occasions revealing the male genital elements as an irregular dark longitudinal stripe on each side of the body, extending from behind the female orifice to the anal region.

Counting the first ocu-
liferous ring as the first ring there are in all 109 rings, which appear to be grouped somewhat as follows,—
somites i, ii, iii and xxvii are uniannulate; xxv and xxvi biannulate; iv triannulate; v and xxiv quadriannulate, of which the lat-

ter occasionally bears five rings owing to the subdivision of the last ring. The eighteen somites vi-xxiii are complete, each being formed of five rings of nearly similar width. On some occasions

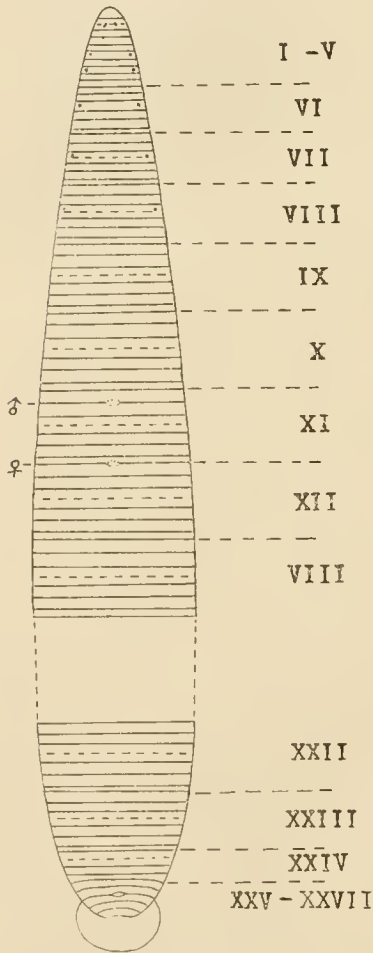


TEXT-FIG. 4.—*Herpobdelloidea lateroculata*, gen. et sp. nov.

Diagram of the anterior and posterior extremities: dorsal view.

rings 2 and 3 are transversely subdivided into two primitive rings.

As is seen from text-fig. 4, there are six pairs of eyes, of which the first and largest pair occur dorsally on either side of the median line in somite iii, while the other pairs are arranged submarginally on the ventral side. The second pair lie in the second ring of somite iv; the third in the second rings of somite v, the remaining three pairs respectively in the middle ring of each of somites vi-viii. The last pair represents the smallest spots. Occasionally just in front of the first pair occur a small pair of provisional eye-spots.



TEXT-FIG. 5.—*Nematobdella indica*, gen. et sp. nov.

Diagram showing the anterior and posterior extremities, as seen from the dorsal side.

The male genital orifice is placed on the middle ring of somite xi; the female orifice lies two rings behind the male, that is between somites xi and xii.

The anus is situated dorsally between somites xxiv and xxv.

As is apparent from the above, the present species seems to be closely related to the genus *Herpobdella*, but stands distinctly at variance from it in the six pairs of eyes, of which the first pair occur dorsally in somite ii, the other five pairs laterally in each of somites iv-viii respectively. It appears to me that the difference is of sufficient value to separate the two forms generically.

Genus *Nematobdella*, nov.

17. *Nematobdella indica*, sp. nov.

(Text-fig. 5.)

Some representatives of this interesting leech were found at the base of the Simla Hills near Dhurampur Kooa, Patiala State.

The body is elongate, slender, and of a nearly uniform breadth for its greater length, though it

tapers towards the anterior more than the posterior end, which is bluntly rounded. The papillae are very weakly developed on the dorsal surface and present no regularity in arrangement. The posterior sucker is a small circular disc with a diameter about half as wide as the greatest breadth of the body. The large specimens are 45 mm. in length by 4 mm. across at the middle of the body.

The colour is faded in spirit, being a translucent olive-brown without any trace of pattern.

The external rings, numbering about 126, are grouped somewhat as follows,—somites i, ii and xxvii are uniannulate; iii, xxv and xxvi biannulate; iv, v and xxiv triannulate; the eighteen somites vi-xxiii are complete with six rings, which are not of similar width, the third ring being enlarged and the last the narrowest of all. The enlarged ring in each typical somite is divided transversely by a superficial furrow. The same is true of the ring corresponding to somite ii.

The six pairs of eyes are arranged in similar manner to those found in the preceding species. The first pair are placed dorsally in ring 2, while the other pairs occur on the ventro-lateral side of the body. The second pair lie in the second ring of somite iv; the third in the first ring of somite v; the other three pairs respectively in the third ring of each of somites vi-viii.

The male genital orifice is situated between the first and second rings of somite xi; the female orifice is five rings behind the male, between somites xi and xii.

The nephridial pores, although difficult to detect, are situated in the furrow separating the second and third rings of the complete somite.

The anus opens dorsally between somites xxv and xxvi.

The clitellum embraces about four somites, ix-xii.

This interesting leech agrees in its arrangement of eyes with the preceding species, but it is separable from it chiefly in having the complete somite with six rings, which, as mentioned above, are not of similar breadth.

Genus *Foraminobdella*, nov.

18. *Foraminobdella heptamerata*, sp. nov.

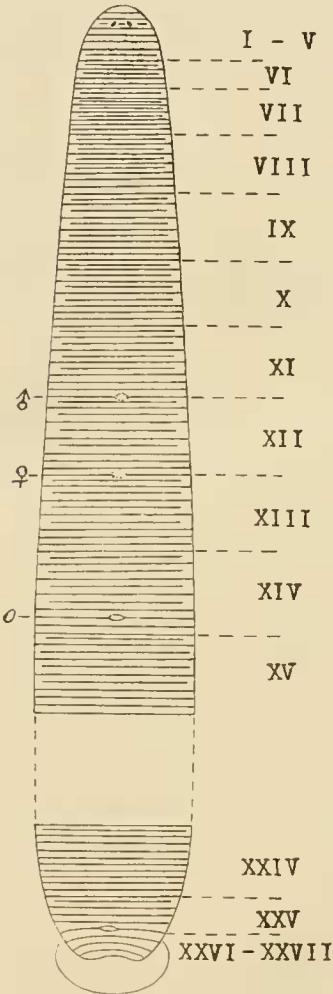
(Text-fig. 6.)

A single representative of this interesting species was found by Capt. R. B. Seymour Sewell, I.M.S., in a stream at Neduattan, at an altitude of 6200 ft., in the Nilgiri District, Madras. The specimen had not been preserved in a state satisfactory for close examination.

The body, which is oval or circular in cross section, is smooth on the surface and of nearly similar breadth for the greater part of its length. The posterior sucker is small and circular in outline, its diameter being about half as wide as the greatest width

of the body. The length of the body is 40 mm. and the breadth about 5 mm. at the middle.

The dorsal surface is of a black colour, while the ventral surface is much lighter than the dorsal, and of an olivaceous colour.



TEXT-FIG. 6.—*Foraminobdella heptamerata*, gen. et sp. nov.

Diagrammatic representation of the anterior and posterior extremities; dorsal aspect. o., dorsal opening of digestive tract.

of the digestive tract, which occupies a position on the mid-dorsal surface, as is the case with *Trematobdella perspicax* (R. Blanchard). So far as my observation goes, it seems to lie between the fifth and sixth rings of somite xiv. Such a peculiar opening of the digestive tract is also known to occur in Horst's *Nepheleis dubia* from Sumatra, described by that author, in which the tract opens to the exterior on the ventral surface by a pair of slender

The somites, although not traced out definitely may be regarded as being grouped somewhat as follows,—somites i, ii and iii are uniannulate; iv, xxvi and xxvii biannulate; v triannulate; vi and xxv quadriannulate; the eighteen somites vii–xxiv are complete with seven rings. In each typical somite the first four rings are enlarged and usually divided transversely either superficially or completely, but the remaining three are narrow. In somite v the last two rings are fused on the ventral surface to form the posterior margin of the anterior sucker. The superficial division is to be seen in the ring corresponding to somite iii, in the first and second rings of somite vi as well as in the first ring of somite xxv.

There are a pair of eyes which are placed in ring 3.

The male and female genital orifices are separated by seven rings, being situated respectively just behind the last ring of somites xi and xii.

Great interest is attached to an external opening

passages. The openings lie twenty rings behind the male genital orifice.

The anus lies on the dorsal surface between somites xxv and xxvi.

The clitellum embraces four somites, x-xiii.

In spite of the existence of a dorsally situated opening of the digestive tract, this leech may be distinguished from *Trematobdella* by the difference in the number and arrangement of rings composing the typical somite; in this respect it seems to be somewhat related to *Mimobdella*. To me it appears to represent a new genus of the Herpobdellidae.

Genus *Scaptobdella*, R. Blanchard.

19. *Scaptobdella horsti*, R. Blanchard, 1897.

I refer five specimens from Java to Blanchard's *Scaptobdella horsti* which is known to occur also in Sumatra and Borneo. The present material was found at an elevation as high as about 4700-6500 ft. in Tjibodas.

The body, presenting some resemblance in its external feature to the earth worm, is soft, smooth on the whole and oval or circular in cross section, its anterior end being narrower than the rounded posterior end. The lateral sides of the body are nearly parallel for the greater part of its length. The posterior sucker is in the form of a shallow circular disc with a diameter rather less than the breadth of the body. All the specimens are of nearly similar size, about 175 mm. long, exclusive of the posterior sucker, by 12 mm. across.

The ground colour, though faded in spirit for the most part, is dark olive without any trace of markings.

The complete somite is formed of six rings, of which the first two rings are broadest, in most instances being divided transversely by a superficial furrow into primitive rings. On some occasions, especially in the hind region of the body, the same subdivision is to be found on the other narrower rings of each typical somite, excepting the fifth ring.

No trace of visual organs has been detected in the present species.

The male genital orifice lies between the third and fourth rings of somite xi, and the female orifice is six rings behind the male, that is on the third ring of somite xii. In one case there is found a minute aperture at the dorso-lateral edge of the ring just behind that bearing the female orifice.

The anus is placed on the dorsal surface just in front of the last three rings of the body.

The clitellum embraces twenty-one rings, as described by R. Blanchard, extending from the second ring of somite x to the first ring of somite xiii.

Family GNATHOBDELLIDAE.

Genus *Whitmania*, R. Blanchard.20. *Whitmania laevis* (Baird), 1869.*Hirudo laevis*, Baird, 1869.*Leptostoma pigrum*, Whitman, 1886.*Whitmania pigra*, R. Blanchard, 1887.

The two examples which I have identified with *Whitmania laevis* were collected by the Manipur Survey party at Pagla Nadi and from Thanga Island. This species is very wide in its distribution, being well known to occur in Japan, the Amur region, China, the Philippines, Malacca, India, Celebes, Sumatra and elsewhere.

The body is large and tapers considerably towards the anterior end. A short distance behind the anterior tip is a slight constriction in the specimen from Thanga Island. The specimen from the latter locality is of larger size than that from Pagla Nadi, and is about 140 mm. in length and 18 mm. in breadth at the middle of the body.

The anterior sucker is very small, lying ventrally within the limits of rings 1-6. The jaws, presenting three small alternate folds, are devoid of proper denticles, but are beset with two series of irregular, thin denticular plates, which are more or less united, especially at the outer and inner angles, where the two series bend, as mentioned by Whitman, into each other.

The posterior sucker is somewhat ventrally attached and circular in outline, about 8 mm. in diameter.

The body is formed of 107 rings, of which rings 6 and 7 are fused ventrally to form the posterior boundary of the anterior sucker, and rings 8 and 9 are also united on the ventral side. On the dorsal side coalescence is found between the two rings of somite xxvi. The same is true of the last two rings. All the rings are grouped, as usual, into twenty-seven somites as follows: somites i, ii and iii are uniannulate, iv, v, xxvi and xxvii biannulate; vi triannulate; vii and xxv quadriannulate; the seventeen somites viii-xxiv are complete with five rings.

The five pairs of eyes are arranged as in *Hirudo*, that is in rings 2, 3, 4, 6 and 9 respectively.

The segmental papillae are so regularly arranged as to exhibit six longitudinal rows on both sides, dorsal and ventral. In the complete somites they occur on the middle ring.

The male genital orifice in the two examples from Manipur occurs in the middle of ring 34, that is on the last ring of somite xi, and the female orifice is five rings behind the male, that is slightly anterior to the centre of the last ring of somite xii. Occasionally both the orifices are displaced near the anterior edge of the corresponding rings, appearing, in preserved specimens, to lie between the rings. In an example from Japan included in the collection the male and female openings appeared to be respectively between the last two rings of somites xi and xii.

The nephridial pores comprise in all seventeen pairs, lying in the furrow separating the second and third rings of the middle seventeen somites.

The anus opens on the dorsal surface just behind the last ring.

The body, though showing some individual variations in colour and markings, is usually brownish olive or olive-yellow, with five black stripes, one median and two lateral, along each of which are found, at regular intervals, oval or quadrangular spots which are free from pigment. In the second and third rings of each somite the spots are divided into two by a transverse line. On each side of the median stripe is seen a shadowy stripe, which, in some instances, may be marked by clear spots. The margins of the body are generally of a lighter colour, bordered on the inner side with a narrow stripe of black, or with flecks of the same colour. A specimen from Japan is of a greyish-olive colour with dark brown stripes, along which the spots are much reduced in size or sometimes wanting.

The ventral surface is generally dotted with black flecks, which alongside the lateral margin are so numerous that they form broad black borders.

Genus *Limnatis*, Moquin-Tandon.

21. *Limnatis nilotica* (Savigny), 1822.

I have examined a single example¹ identical with *Limnatis nilotica*, which occasionally attaches itself to the mouth, throat, and nasal cavity of human beings and cattle, generally causing haemorrhage. It represents one of six specimens obtained at Quetta, Baluchistan, from the throat of an Austrian soldier.

This leech has a wide distribution, extending from the Azores, through part of Western Europe as well as Northern Africa, to part of Western Asia, and even into the boundaries of the Indian Empire. It can be easily distinguished from the following, *L. granulosa*, by the difference in colour markings.

22. *Limnatis granulosa* (Savigny), 1820.

This species represents one of the commonest Indian leeches, numerous examples having been collected at several localities: Panjab, Bombay, Mysore, Madras, Orissa, Bihar, Assam, Burma, Ceylon and elsewhere. As has been mentioned in a recent account (*loc. cit.*), this leech exhibits great variability in colour and markings.

L. javanica (Wahlberg), which is known to occur in Java, Borneo, Sumatra, Burma, Bengal, etc., is nearly allied to the present species, but can be easily distinguished from it by the separation of the genital orifices by seven instead of five rings as well as by the enormous size of its posterior sucker.

¹ See Kaburaki. *Rec. Ind. Mus.* XVIII. p. 213 (1921).

Genus *Haemopsis*, Savigny.23. *Haemopsis sanguisuga* (Linnaeus), 1758.

The three specimens of this well-known leech which occurs throughout the greater part of Europe, were obtained by Capt. R. B. Seymour Sewell from the Waddi Gwyzie (Gaza) in Palestine. It is of particular interest that its range extends into Transcaucasia, Syria and Palestine. As is well known the term "horse-leech" or "cattle-leech" is applied to this species more than *Limnatis nilotica*; it frequently occurs in springs, and thereby causes great discomfort and even danger. This species has, especially in the last few years, been subjected to many changes of name (see Harding, 1910).

The body is smooth on the surface, attenuated anteriorly and bluntly rounded posteriorly, its lateral sides being more or less parallel for the greater part of its length. The posterior sucker represents a large circular disc and is almost centrally attached. The largest specimen was 30 mm. long, in front of the posterior sucker, by 11 mm. across at the middle of the body.

The colour in spirit is dark brownish, appearing to show some traces of geometrical patterns on the dorsal surface.

There are 103 rings, of which rings 6 and 7 are fused ventrally to form the posterior boundary of the anterior sucker. The same is true of rings 8 and 9 on the ventral side. Somites i, ii, iii and xxvii are unianulate; iv, v and xxvi biannulate; vi, vii and xxv triannulate; viii quadriannulate; the sixteen somites ix-xxiv are complete with five rings.

The five pairs of eyes lie respectively in rings 2, 3, 4, 6 and 9.

The male genital orifice is situated between rings 31 and 32, that is between the fourth and fifth rings of somite xi; the female orifice lies five rings behind the male, that is between the last two rings of somite xiii.

The nephridial pores, numbering in all seventeen pairs, are placed in the furrow between the second and third rings of the middle seventeen somites.

The anus opens dorsally just behind the last ring of the body.

24. *Haemopsis birmanica*, R. Blanchard, 1894.

Haemopsis weberi, R. Blanchard, 1897.

The collection contains some examples of a species which agrees precisely with Blanchard's *Haemopsis weberi* from Sumatra. The latter may be regarded as synonymous with *H. birmanica* from Burma described by the same author, and here I have so treated it. This leech is closely allied to *Haemopsis sanguisuga*, so that I was for some time inclined to regard it as a variety of that species. The specimens examined were obtained from various parts of the Darjiling District, the East Himalayas, at Lahore and also at Khunlan in Siam. It is of some interest that an example from Lahore was found in the nasal cavity of a horse.

The body is very closely similar in its external features to *Haemopsis sanguisuga*, being entirely devoid of segmental papillae and possessing a large posterior sucker. The largest specimen is 145 mm. in length, exclusive of the posterior sucker, and 18 mm. in width at the posterior region of the body.

The colour in spirit is dark grey on the dorsal and lighter on the ventral surface, without being marked with any trace of pattern.

Counted on the dorsal surface are 104 rings, of which rings 6 and 7 are fused on the ventral surface to form the posterior margin of the anterior sucker. The same is true of rings 8 and 9 on the ventral surface. On some occasions ring 14 is subdivided transversely into two on the ventral surface, and rings 96 and 97 present a tendency to fuse on the dorsal surface. Somites i, ii and iii are uniannulate; iv, v, xxvi and xxvii biannulate; vi, vii and xxv triannulate; viii quadriannulate dorsally, but occasionally with five rings ventrally owing to the subdivision of the first ring (14). The sixteen somites ix-xxiv are complete with five rings.

The eye-spots are very small and are not discernible easily from the exterior, their arrangement quite agreeing with that found in *Haemopsis sanguisuga*.

The male genital orifice is situated near the anterior edge of the last ring of somite xi, and the female orifice lies five rings behind the male, between the fourth and fifth rings of somite xii.

The anus is situated on the dorsal surface just behind the last ring of the body.

The clitellum extends over four somites, x-xiii.

25. *Haemopsis concolor*, sp. nov.

(Text-fig. 7.)

The three individuals, which seem to represent a new species, were collected by Dr. B. Prashad from a spring at Kasauli in the Western Himalayas.

In shape the body is much like the preceding two species and is smooth on the whole, there being neither papillae nor tubercles to roughen the surface. The larger specimen is 40 mm. long by 6 mm. broad, while the smaller is 5 mm. long by about 1.5 mm. across.

The body is of a dark olive colour, without any trace of markings.

In front of the posterior sucker there are 103 rings, of which rings 8 and 9 are fused on the ventral side. Somites i, ii, iii and xxvii are uniannulate; iv, v and xxvi biannulate; vi, vii and xxv triannulate; viii quadriannulate; the sixteen somites ix-xxiv are complete with five rings. In the small examples the furrows marking the boundaries of the somites appeared somewhat conspicuous in consequence of the curvature which the body had assumed in preservation. It is of some interest that the furrows separating the rings in some somites are not of similar depth, differing from

the other species of *Haemopsis*. The shallower furrow is the one separating some rings of somites vii-xi and xxvi, as is shown in text-fig. 7 by the broken line.

The arrangement of eyes is in agreement with that of *Haemopsis sanguisuga*.

The male and female genital orifices occupy a position respectively between the last two rings of somites xi and xii.

The nephridial pores are situated in the furrow between the second and third rings of the middle seventeen somites.

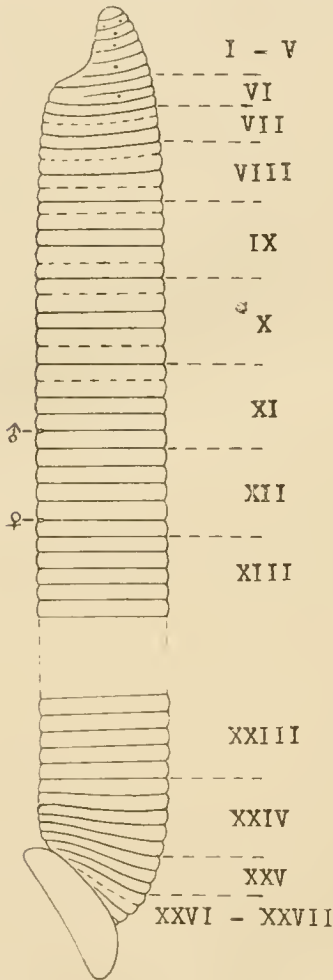
The anus is located on the dorsal surface just behind the last ring of the trunk.

This leech appears to be nearly allied to *Haemopsis sanguisuga*, but may be distinguished from it by the different annulation of the body.

Genus *Myxobdella*, Oka.

26. *Myxobdella annandalei*, Oka, 1917.

There was in the collection a single example which may be identical with Oka's *Myxobdella annandalei* from Hong Kong described by that author. The specimen was found in a hill stream at Yercaud, Madras.



TEXT-FIG. 7.—*Haemopsis concolor*, sp. nov.

Diagram of the anterior and posterior extremities, as seen from the lateral side.

part, though it tapers off considerably in front. The dorsal surface is convex throughout while the ventral is nearly flat. The posterior sucker is circular in outline and in the preserved state is entirely hidden when viewed from above. The specimen measured 17 mm. in length and about 4 mm. in breadth at the middle of the body.

As has been described by Oka in detail, the most conspicuous of the external features is that the body is divided by deep furrows

into well-bounded somites. So far as my observation goes, somites i, ii, iii and xxvii are uniannulate; iv, v and xxvi biannulate; vi, vii, xxiv and xxv triannulate; viii and ix quadriannulate; the fourteen somites x-xxiii are complete with five rings. In each typical somite the furrows separating the rings are not of equal depth, the deepest ones being always found between the second and third as well as the third and fourth rings. The furrow between the first and second rings is, in most instances, the shallowest of all.

The five pairs of eyes are arranged in the same manner as those observed in *Hirudo* or *Haemopsis*.

The male and female genital orifices are placed between the fourth and fifth rings of somites xi and xii respectively.

The anus opens on the dorsal surface just behind the last ring of the body.

Genus *Haemadipsa*, Tennent.

27. *Haemadipsa zeylanica* (Moquin-Tandon), 1826.

Hirudo zeylanica, Moquin-Tandon, 1826.

Hirudo flava, Schmarda, 1861.

Hirudo (*Chthonobdella*) *sumatrana*, Horst, 1883.

Haemodipsa sylvestris, R. Blanchard, 1894.

In his paper R. Blanchard puts on record a form closely resembling the present leech as a distinct species, *Haemadipsa sylvestris*, chiefly on account of the presence of a narrow interpolated ring between the two oculiferous rings 4 and 5, which, according to a careful examination of a large series of examples, appears not to be of a constant occurrence. I am, therefore, of the opinion that this difference may be regarded as being of insufficient value to separate the two forms specifically.

As is well-known the species is of wide distribution in the Oriental region, it having hitherto been recorded from Ceylon, the Himalayas, Burma, Cochin China, Tonkin and also from various localities in the Indo-Malayan Archipelago, such as Sumatra, Borneo, Celebes, Java, etc. The collection which I have examined contained a great number of this species obtained from several localities in India and its vicinity: at elevations of 1300-6500 ft. in the Darjiling District, the East Himalayas, Assam, Central Provinces, Madras, Lower Burma and elsewhere.

The body is nearly cylindrical, tapering gradually towards the head end. Centrally attached is a circular posterior sucker which is rather less than the greatest width of the body. The large specimens are about 40 mm. long, excluding the posterior sucker, by 7 mm. across at the posterior region of the body.

The body consists generally of 98 rings, of which rings 5 and 6 coalesce ventrally to form the posterior margin of the anterior sucker. Among the examples with the same colour markings from Kovalai, at elevations of 1300-3000 ft., in Cochin State, there was one individual only in which rings 7 and 8 are also fused on the ventral side. On some occasions a narrow ring occurs interpolated between the oculiferous rings 4 and 5, but this, so far as my observa-

tion goes, is not constant in occurrence, as mentioned above. Somites i, ii, iii, iv, xxvi and xxvii are, it seems to me, unianulate; v and xxv biannulate; vii and xxiv triannulate; viii quadriannulate; the fifteen somites ix-xxiii are complete with five rings. Occasionally somite iv is composed of two rings owing to the presence of a narrow interpolated ring.

There are five pairs of eyes, of which the first four pairs are usually arranged in a semicircle in rings 2, 3, 4 and 5, and the fifth pair lie two rings behind the fourth, that is in ring 8.

On both sides, dorsal and ventral, are found six segmented papillae which generally fall on the middle ring of each typical somite.

The male and female genital orifices are separated by five rings, lying between the last two rings of somites xi and xii respectively.

The nephridial pores, numbering in all seventeen pairs, open laterally in the furrow separating the second and third rings of the middle seventeen somites.

The anus opens dorsally just behind the last ring of the body. The clitellum extends over four somites, x-xiii.

This species is generally of a yellowish colour variegated with brown, but exhibits great variability in markings. So far as my observations are concerned, there are distinguishable four varieties, which occur associated together, but with some intergrading forms.

(i) In a few specimens from the East Himalayas and Bengal the dorsal surface is divided into three longitudinal areas. a median and two lateral. The median area is lighter in colour, and slightly narrower than the lateral areas which present a dark brown colour, getting lighter towards the lateral margins of the body. The median area is traversed longitudinally by a thick dark brown median stripe, which extends with the lateral bands throughout the whole length of the body, but in some cases it vanishes, or nearly so, on the dark head end.

(ii) Some examples obtained from several localities of the Assam, Bengal and Bilar Districts, as well as of Lower Burma, are generally marked on the dorsal surface with three fine dark brown stripes, one median, and on each side one lateral, in position corresponding to the boundary line between the median and lateral areas mentioned above. On some occasions the median stripe is faint or sometimes obsolete.

(iii) In examples from several places in the East Himalayas and Cochin State the markings agree in their plan with the forms mentioned above, but may be distinguished from these by the different aspect of the lateral bands which are very faint or sometimes obsolete.

(iv) In some forms from the East Himalayas, North Kanara, Madras and Cochin State the body is marked on both sides, dorsal and ventral, with dark brown blotches, which occasionally join together in the positions corresponding to the dorsal and lateral areas.

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